PROYECCIÓN DE POBLACIÓN MANATÍ 2005-2025

Años	2000	2005	2010	2015	2020	2025
Manatí	45,409	49,193	53,292	57,733	62,544	67,755

Cada 5 años se proyecta un aumento de 3 a 4 mil habitantes. El Municipio con mayor crecimiento poblacional en la Región Norte es Florida.

NECESIDAD DE VIVIENDA
PUERTO RICO, ARECIBO Y MANATÍ 1995-2005

	Viviendas	Necesidad	Necesidad
Lugar	1990	1995	2005
Manatí	13,337	1,406	2,888
Arecibo	32,458	3,811	3,491
Puerto Rico	1,097,066	129,503	190,113

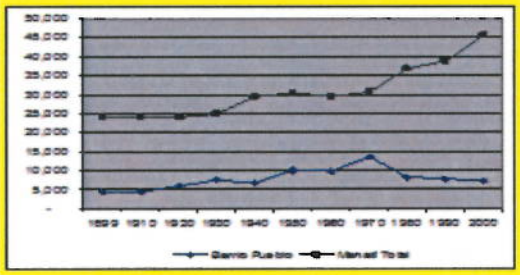
Fuente: Proyecto Puerto Rico: 2005

Se proyectó un aumento de necesidad de vivienda en Manatí de 21.7%, mientras Puerto Rico reflejó 17.3%.

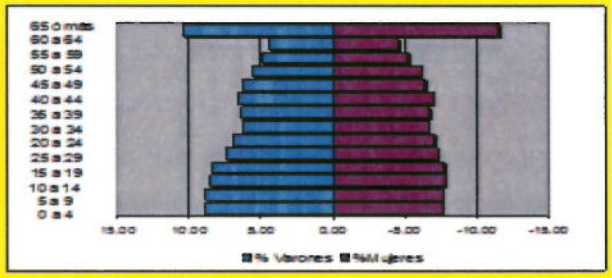
In addition, we see an increased in population of residents 65 years of age or more, hence the provision of geriatric services should be addressed.

CARACTERÍSTICAS DE LA POBLACIÓN

EVOLUCIÓN DE LA POBLACIÓN MUNICIPIO DE MANATÍ 1930-2000



PIRÁMIDE DE POBLACIÓN MUNICIPIO DE MANATÍ, AÑO 2000

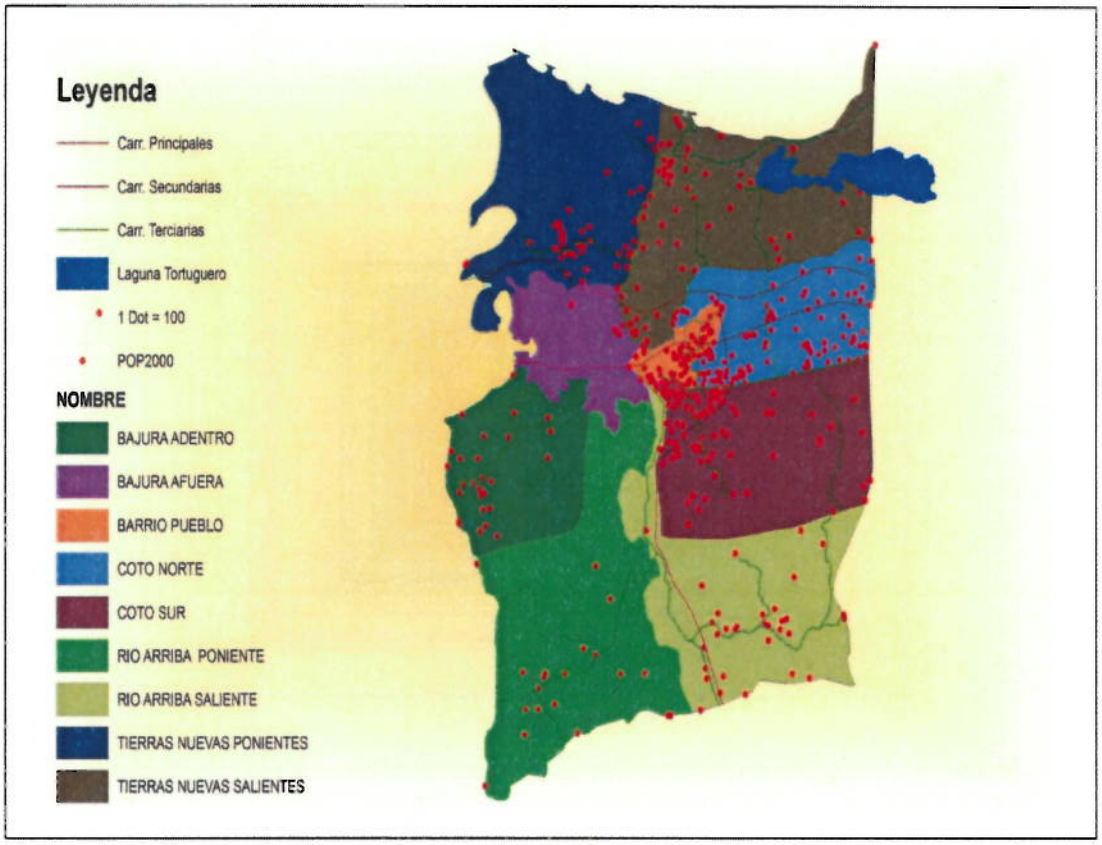


45,409 habitantes en 45.20 millas2 con 1,005 personas por milla2.

Aumento en la población +65 y en los nacimientos, por tanto la provisión de servicios debe dirigirse a servicios geriátricos y servicios a niños y jóvenes de 0-14 años.

In 2000 most of Manat's population, 92.49% or 41,997 lived in an urban area.

Municipio Autónomo de Manatí
Distribución Poblacional Por Barrios, Censo 2000



The distribution of the population in urban and rural districts in 2000 is shown in the following table:

Comparative of Urban and Rural Population by Sector, in Manati

1990 and 2000 Census

Sector	Urban 1990	Rural 1990	Urban 2000	Rural 2000	Total 1990	Total 2000
Bajura Adentro	0	2,395	2,064	248	2,395	2,312
Bajura Afuera	364	77	491	158	423	649
Coto Norte	8,738	127	11,374	0	8,865	11,374
Coto Sur	6,512	1,111	8,215	741	7,623	8,956
Manatí Pueblo	7,750	0	7,131	0	7,750	7,131
Río Arriba Poniente	0	1,681	841	913	1,681	1,754
Río Arriba Saliente	0	2,394	2,477	691	2,394	3,168
Tierras Nuevas Poniente	2,619	795	3,698	661	3,414	4,359
Tierras Nuevas Saliente	1,302	2,845	5,706	-	4,147	5,706
Total	***27,285***	***11,425***	***41,997***	***3,412***	***38,692***	***45,409***

Source: Census Population 1990 and 2000.

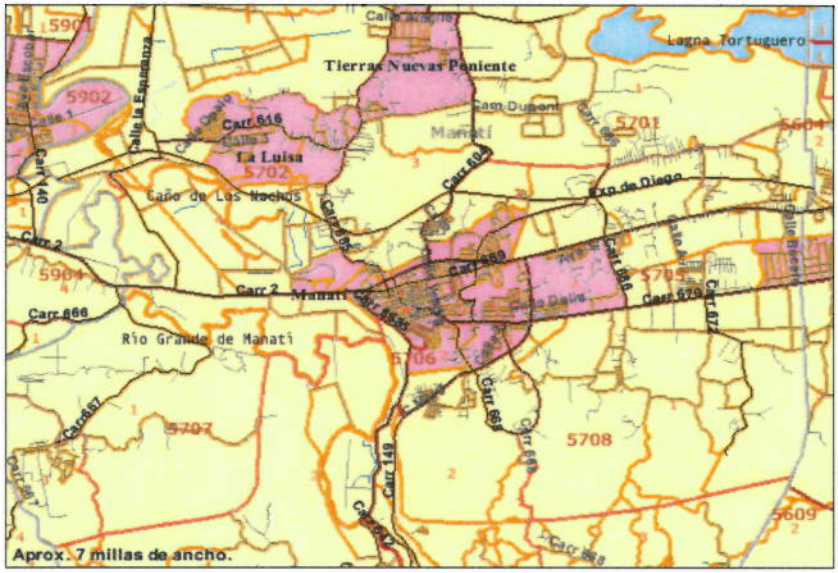
Percentage of Urban and Rural Population – Municipality of Manatí,

Census 2000

Census	Urban	%	Rural	%	Total	% Urban
Bajura Adentro	2,064	4.91	248	7.27	2,312	89.27
Bajura Afuera	491	1.17	158	4.63	649	75.65
Coto Norte	11,374	27.08	-	0.00	1,374	827.80
Coto Sur	8,215	19.56	741	21.72	8,956	91.73
Manatí Pueblo	7,131	16.98	-	0.00	7,131	100.00
Río Arriba Poniente	841	2.00	913	26.76	1,754	47.95
Río Arriba Saliente	2,477	5.90	691	20.25	3,168	78.19
Tierras Nuevas Poniente	3,698	8.81	661	19.37	4,359	84.84
Tierras Nuevas Saliente	5,706	13.59	-	0.00	5,706	100.00
Total	***41,997***	***100.00***	***3,412***	***100.00***	***45,409***	***92.49***

Source: Census Population 2000.

Map Manati's Urban Areas, Census 2000



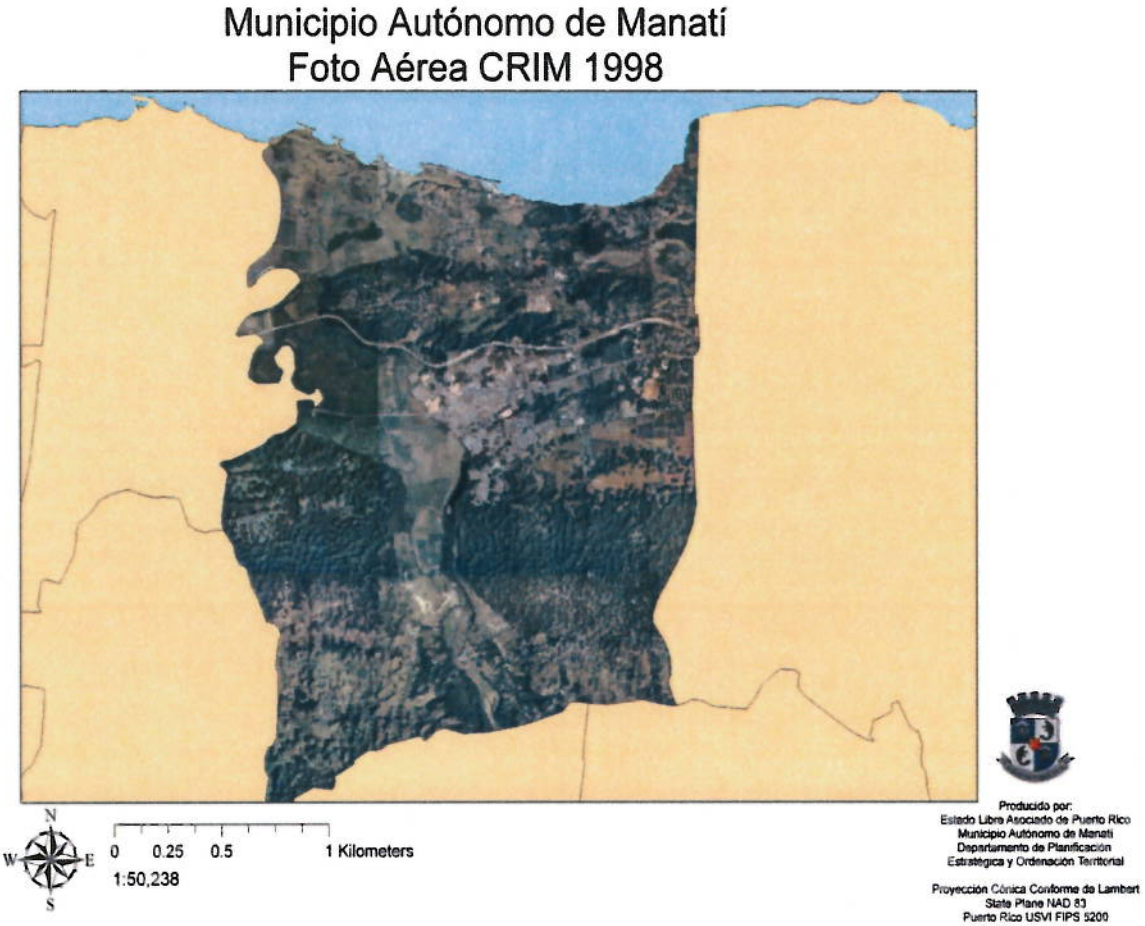
Source: American Factfinder.census.gov2000

In addition, the Land Use Plan of Manati, approved in 2002, distributed land classifications, as follows:

Extension of the Classification of Land Municipality of Manati		
Type Of Classification	**Area m^2 (Curds)**	**Distribution Percentage**
Urban Land	9,093,161.79821875m^2 (2,313.55 curds)	7.63%
Common Rustic Land	8,342,500.5378m^2 (2,122.56 curds)	7.0%
Specially Protected Rustic Land	99,697,983.08023125m^2 (25,365.89 curds)	83.73%
Programmed Urban Land	1,100,510.775m^2 (280 curds)	.09%
Non Programmed Urban Land	825,383.08125m^2 (210 curds)	0.7%
Total	119,059,544.2725m^2 (30,292 curds)	100%

Importance of Manati in the Region:

Manati is important in the Northern Region for several reasons, some are: employment opportunities located within the municipal boundary, its natural resources and its historical area.



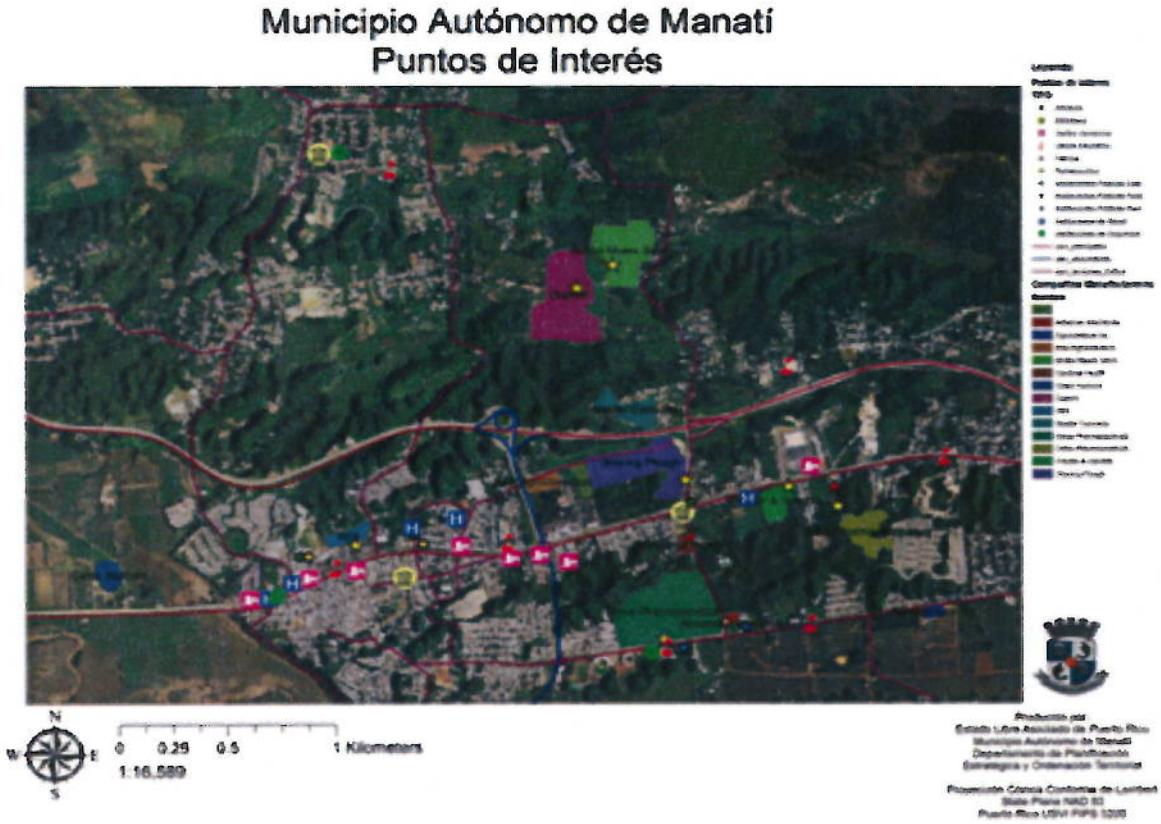
The Municipality of Manati is a regional center of great importance. According to the Department of Labor and Human Resources, 47% of total employment in the service sector of the Northern Region is located in Municipality of Manati, even though only 15% of the total population in the Northern Region resides in Manati.

Manati is also important to the northern region since 2 out of the 3 natural areas designated in this region are located in the Municipality of Manati. One of the most important natural resources that we can mention is the Tortuguero Lagoon. This resource of regional and insular significance is located between the city limits of the Municipalities of Vega Baja and Manati and near the coastal area. It consists of one of the most important sweet water systems of Puerto Rico. In this area there are many endemic and endangered species.

Another natural area identified is also a historic site. We are referring to The Esperanza Plantation owned by the Conservation Trust.

Perhaps the most important natural resource for this region and for Puerto Rico, would be Aymamón aquifer. This system of groundwater is an element of vital importance to many natural coastal systems, the most important of which is the Tortuguero Lagoon. The aquifer is also vital for industries since it is the main source of drinking water.

Among the most important resources constructed by man found in Manati is its historical area, industries, particularly pharmaceuticals, hospitals and the Highway José de Diego. Most of he industries are located close to State Road PR-2, towards the north and south of it.

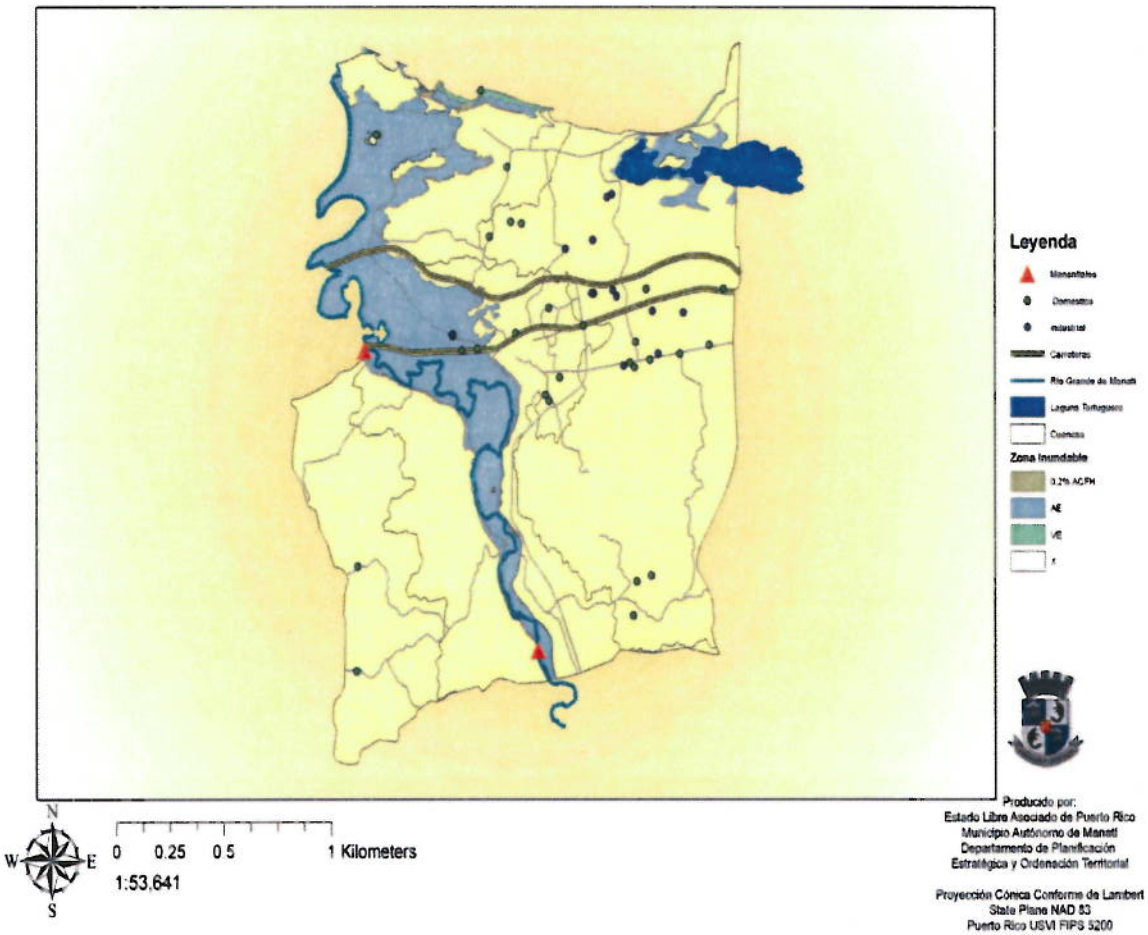


Hydrology

To understand the situation of the Municipality of Manati, it is important to know the surface and groundwater hydrology that sustains the natural resources and human uses of the land.

The Rio Grande of Manati is the second longest river in Puerto Rico, it measures 56.8 miles, and starts in the mountainous interior of the Island. With a flow rate of 275,820 and has two reservoirs: El Guineo located in Ciales and Morovis, and Matrullas in Orocovis. The Rio Grande of Manati is the only major river that runs though the municipality. It feeds from other sources such as: Quebrada, Pugnado, Canas y Terrenes which are located in the valleys of the interior.

Municipio Autónomo de Manatí
Mapa Hidrológico



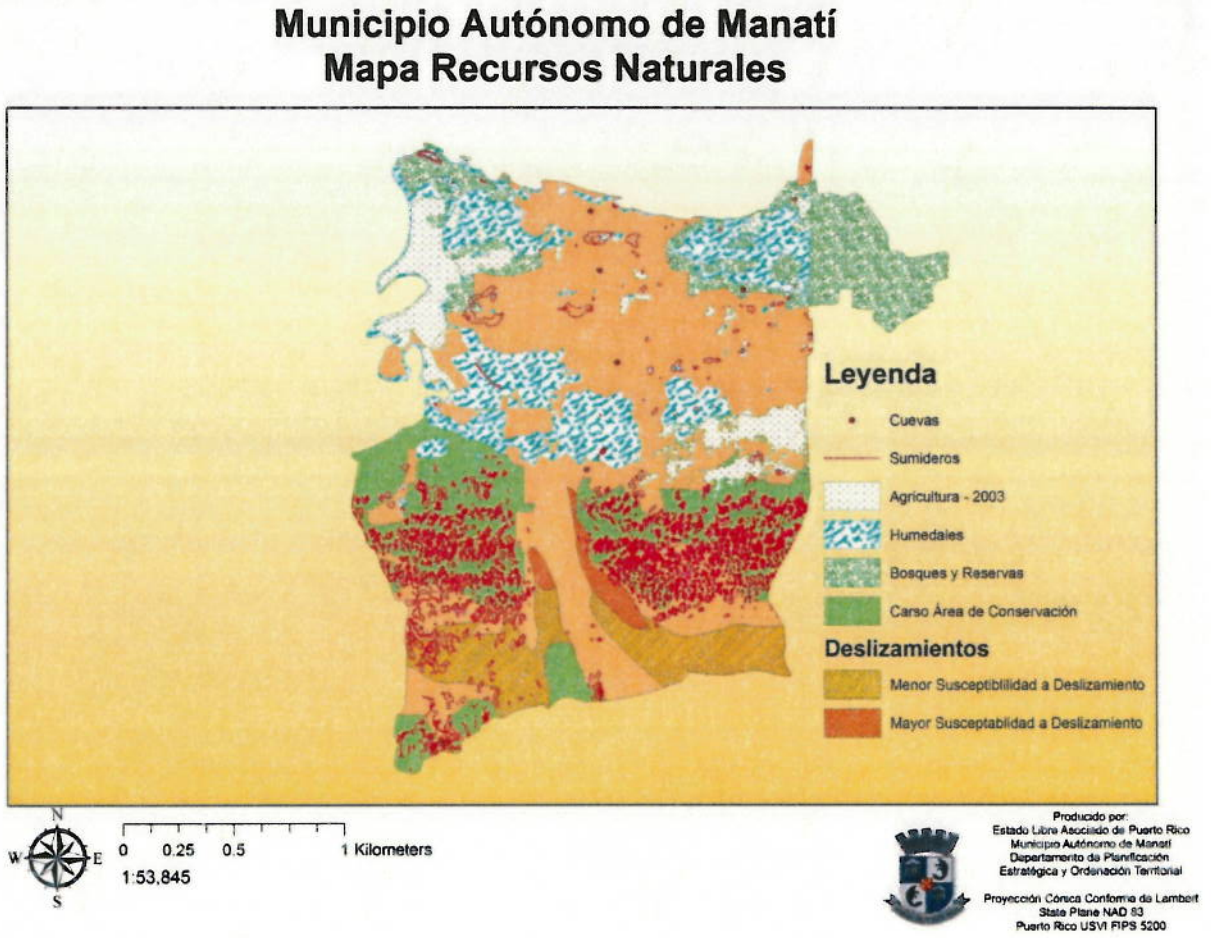
In the coastal valley, the hydraulic capacity of the riverbed of the Rio Grande of Manati is poor, because it discharges the same or greater than the discharges of two years in frequency causing the overflow of waters. The main flooded areas occur on both sides of the River. There are no large communities affected by these floods in the Municipality of Manati.

The underground water system is the most important for the municipality, because it supplies drinking water for human consumption and industrial use, as to the wildlife in the Tortuguero Lagoon. Tortuguero Lagoon and Cartagena Lagoon are the only freshwater lagoons in Puerto Rico.

Aquifers

The aquifers of the northern area stretch from Luquillo to Aguadilla. The most important ones of Puerto Rico are the limestone of the North, with a secondary permeability caused by the dissolution of the rock caused by the action of the water. This formation is mainly found to the west of San Juan, concentrated in the area from Dorado to Arecibo. (Appendix 5)

The karst region of the northern coast is an aquifer, complex in its structure and operation. Its overall structure consists of two Limestones, one above the other, separated by a formation of lower permeability: The Cibao Limestone. The two aquifers are known as the Superior Aquifer and the Inferior Aquifer, also known as aquifer Llano or Freático (Superior) and Profundo or Artesiano (Inferior). Appendix 6.



Sub terrain Water

According to the report "Puerto Rico Water-Use Program: Public-Supply Water Use and Wastewater Disposal During 1990" of the U.S. Geological Survey, the Municipality of Manati did not obtain water from surface sources yet obtained 7 million gallons of water a day from underground sources. For this reason Water wells are an important element in our infrastructure.

Aquifers in the North Coast

The aquifer of the Northern Coast stretches from Luquillo to Aguadilla, occupying an area of approximately 905 MI2 (Appendix 5).

The most important ones of Puerto Rico are the limestone of the North, with a secondary permeability caused by the dissolution of the rock caused by the action of the water. This formation is mainly found to the west of San Juan, concentrated in the area from Dorado to Arecibo.

The karst region of the northern coast is an aquifer, complex in its structure and operation. Its overall structure consists of two limestone aquifer, one above the other, separated by a formation of lower permeability: the Cibao Limestone. The two aquifers are known as the Superior Aquifer and the Inferior Aquifer, also known as aquifer Llano or Freático (Superior) and Profundo or Artesiano (Inferior). Appendix 6 provides a cross section of the area of the Caño Tiburones showing the basic configuration of the formations that make up the aquifers.

The Superior Aquifer consists of limestone rocks with moderate to high levels of permeability over a floodplain, formed by sediments that deposit in river valleys that run through the limestone. This aquifer includes layers of alluvial deposits and marine limestone formations that overlays, primarily the ones named Aymamón, Cibao, Camuy and Aguada (Monroe, 1980). This extends from the Luquillo area towards the west. Its maximum thickness varies depending of the location from east to west, as well as alluvial deposits formed in the immediate valley of the river in that region. The permeability in the limestone is due to winding channels. The Superior Aquifer is a major supply source of water for consumption, industrial and agricultural activities, with a collection of 52 MGD in 2002 (DNRE, 2004). The lower limit of this aquifer is the permeable rock of the Cibao formation.

The inferior aquifer (deep or artesian) includes layers of formations of San Sebastian, Lares and Montebello, confined by layers of mud and silt from the Cibao Formation. The aquifer extends from the metropolitan area of San Juan to Aguadilla, even though the areas with higher capacity of production of water are between Manati and Arecibo. In this area where artesian conditions occur prior to the development of the aquifer, the level of metric power water allows the wells in the area flow without the need for pumping. However, the exploitation of this has led to a dramatic reduction in the level metric power in this aquifer. The inferior aquifer is the main source of water for industrial uses in the area of Manati to Barceloneta, in addition to supplement supplies for moderate consumption. The extraction of water in this aquifer was 7 MGD in 2002 (DNRA, 2004).

The limestone aquifers are recharged through the percolation of rainwater through the ground, by the discharge of surface runoff into sinkholes and by the infiltration through the bottom of the rivers. They can also receive recharge from the discharge of septic tanks and leaks from broken pipes. Both aquifers discharged into the sea, although the upper aquifer discharges towards springs, the bottom of rivers, wetlands and coastal lagoons including the Caño Tiburones and Laguna Tortuguero. The wells in operation also represent points of discharge for both aquifers.

Alluvial Aquifer

The alluvial aquifers are in the flood plains, mainly in the South Coast and in some interior valleys. There are also alluvial aquifers in the North Coast, described above in combination with the limestone. These aquifers in non-consolidated formations of permeable sand and gravel deposited by ancient rivers, now find themselves below the ground surface. The areas of greatest permeability correspond to areas of sand and gravel of the ancestral channels. The most important aquifers are on the Southern Coast (Illustration Appendix 6) and in some interior valleys as Cayey and Caguas. Alluvial aquifers are less productive in the Northern Coast because in this area there are a lot more clay in the sediments and it is very permeable.

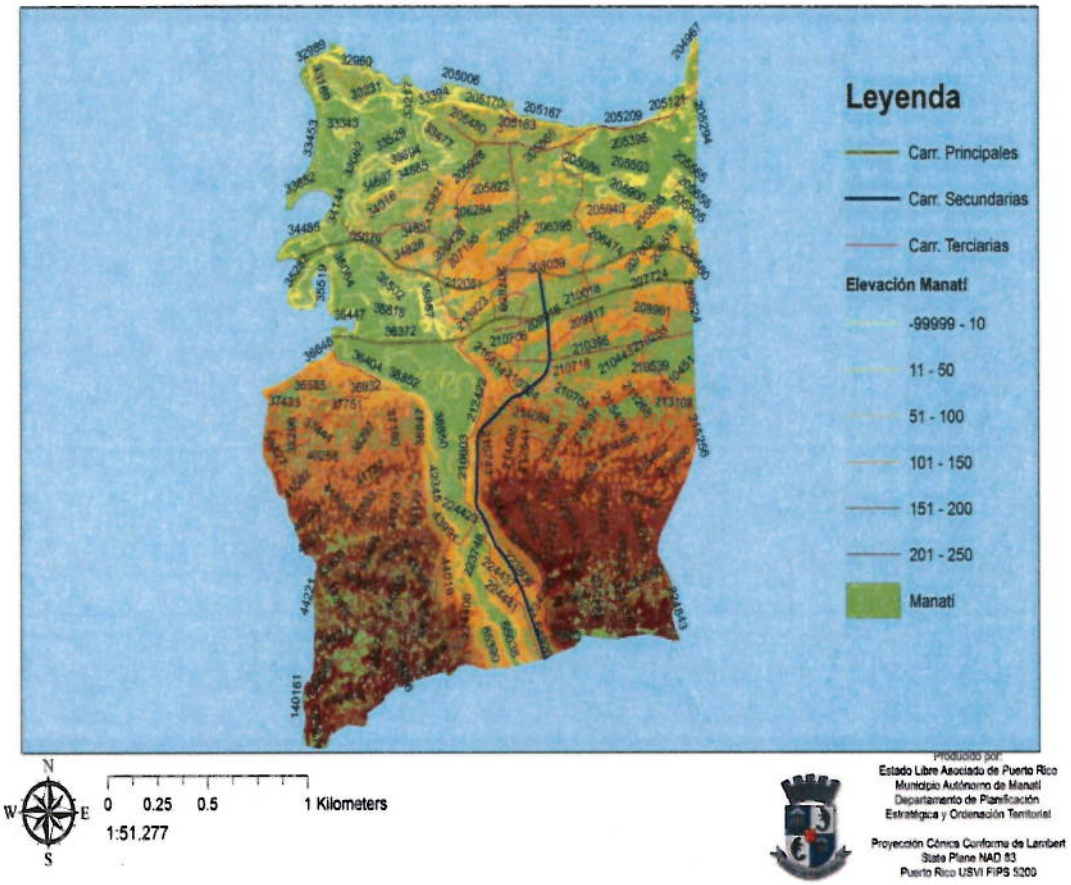
Estuaries

Estuaries are areas where fresh water mixes with seawater. Since fresh water is less dense than salty sea water, estuaries tend to be stratified, which means a layer of freshwater floats above the sea water. In rivers, salt water that enters inland is known as a sea wedge, by entering below the layer of freshwater. Fresh water mixes with sea water, forming saline water. This mixture is produced by the combined action of the tides, waves and the force of surface runoff. Besides stratified estuaries, there are estuaries that are partially blended and others that are completely blended. Due to that the tides, waves and runoff vary in time and space, the estuary is a very dynamic system in regards to the salinity of its water. Within the estuary, the salinity can be equal to that of sea water and change to have intermediate salinity or become fresh water. As the salinity of the water changes, also changes its quality. When the flow of fresh water declines, the wedge of sea water can penetrate the river several kilometers inland. This happens in several of the major rivers of the northern coast, including the Guajataca, Rio Grande de Arecibo, Rio Grande de Manati, La Plata, Rio Grande de Loíza and Espíritu Santo. Heavy rains cause an increase in the flow of fresh water into rivers which in turn back into the wedge of brackish water into the sea.

In Puerto Rico, there are five classes of estuaries. One is formed at the mouth of rivers and lakes systems. The estuary of the river mouth can be separated from the sea by a verge of sand except during short periods in which the rise removes the verge from the mouth. This verge will be re-established by the action of waves from the beach. The pattern of mixing in this kind of estuary shows the normal condition of vertical stratification with saline water on the bottom and a layer of fresh water flowing over the top. When there is little flow of fresh water, for example downstream from reservoirs, movement in this kind of estuary can be essentially paralyzed; saline water is trapped at the bottom with very little input of oxygen which can create anaerobic conditions at the bottom of the estuary for prolonged periods of time.

Another feature of river estuaries is the presence of mangroves, which grow in areas where there is enough salinity (about 5 mg / l) as to prevent the growth of freshwater plants. The mangroves tolerate a wide range of salinity and also grow where there is no fresh water, such as keys and dry shores. The mangrove areas receive input of fresh water, but during most of the year are fed mainly by saline water.

Municipio Autónomo de Manatí
Mapa Topográfico



Freshwater Ecosystems of Native and Exotic Fauna

Upstream migration of juvenile shrimp Macrobrachium, which can occur at the same time as the migration of the cetí (Erdman, 1986), is apparently common in the Rio Grande de Arecibo and Rio Grande de Manati, and has been incorporated into our popular culture.

Hydrological cycle

When comparing the availability (average) of 4,035 mgd of surface runoff plus recharging the aquifers, with 673 mgd used in 2004, you get the impression that there is still some water in Puerto Rico that remains untapped.

Surface runoff

The discharge of the Rio Grande de Manati in 1994 was only 15 percent of the average flow recorded in the last 45 years (USGS Station 50035000, Rio Grande de Manati in Ciales). 50 per cent of the average annual discharge is provided by the overflow that occurs in only 9 percent of the days. In contrast, 50 percent of the days with lower discharges (182 days a year) make up only 14 percent of the average flow.

Topography

The topographic relief of Manati is composed of four types of sectors, the coast, the coastal valley, the humid hills of the valleys interior and the interior valley. The Karst Geology of the municipality, located in the coastal valley and the moist interior of the hills, has important implications on the surface and groundwater hydrology. One of its characteristics is the irregular surface topography due to the high solubility and permeability of the underlying geology. Because of this the Karst superficial drainage system that runs though rivers and creeks is not apparent.

Sinkholes are a natural surface drainage system of this type of karst terrain. It is the natural drainage of water runoff that makes viable the reserves of underground waters. The free passage of water through sinkholes is part of the sinkhole and groundwater system, so it is necessary to keep them clean. Due to the small size of land that can drain towards each other, we are often unaware of the specific locations of the sinkholes. Despite the previously stated, it is necessary to accurately identify their location, size and general characteristics when urbanizing an area where it may exist

because there are no easy alternatives to divert surface runoff away from them. The presence of sinkholes can make more costly the development of urbanization or projects of infrastructure.

The intimate connection between surface water and groundwater implies that there is little or no attenuation of the characteristics of surface water before reaching the underground aquifer. In this kind of topography, the presence of sinkholes, caves and crevices product of the dilution of the formation of limestone from the subsoil makes them more vulnerable to pollution that drags over the superficial sources.

Apart from pollution by man-made products, groundwater, which depends exclusively for sustaining human activities and natural resources, may also be threatened by actions that alter the water level, for example, increase in waterproofing and excess pumping.

Maintaining the quality of habitat of Tortuguero Lagoon is closely related to the quality and quantity of groundwater that feed the system. According to the study to establish the Public Policy on Use and Management of the Tortuguero Lagoon, it is estimated that the aquifer Aymamón produces the greatest amount of water to the lagoon.

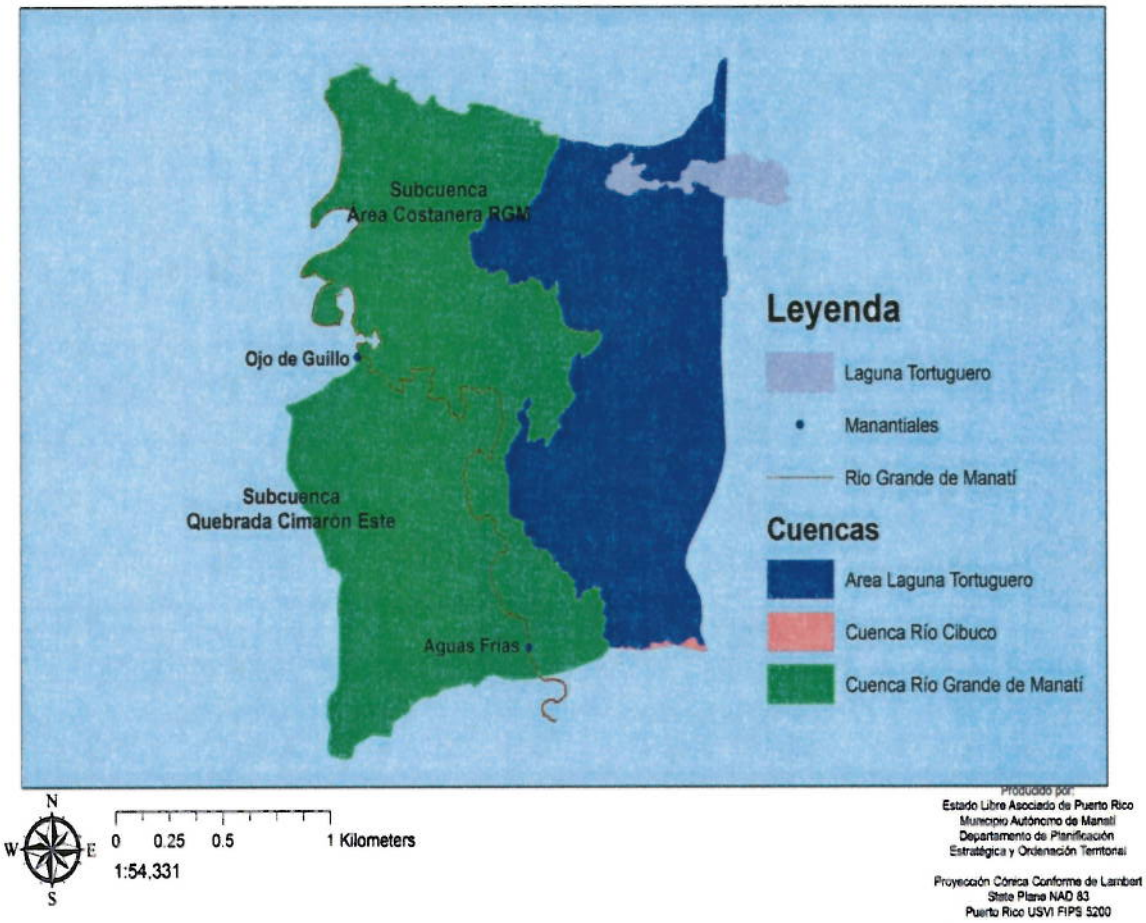
The Tortuguero Lagoon represents the base level of the regional flow of groundwater in the area between the Cibuco River and the Rio Grande of Manati. The level of the aquifer that recharges the Lagoon is represented by a highly permeable member of the Aymamón formation. It is believed that the area that recharges the Aymamón aquifer is a very important area for the protection of the lagoon.

The water balance that has reached the natural Tortuguero system depends on the groundwater that comes from inland. The basins of the groundwater system were delimited by the end of the sixties with the objective of designing a special regulation to avoid the paving of the basin. This would help keep the ground within the basin available for the percolation of rainwater.

The next map illustrates the extent of the basin of the Tortuguero Lagoon within the municipal boundary of Manati. As it can be observed, the basin covers almost half the land in the Municipality. Much of the basin is covered by Limestone Hills. The limestone that forms these hills is very porous so that rain water can percolate into the groundwater with ease. In addition, one of the characteristics of this type of geology is the presence of sinkholes, or relatively vertical holes that go directly to the aquifer.

The Super Aqueduct integrates 3 of the largest watersheds available on the island and where there is more rainfall during the year. The Super Aqueduct by having an easement or right of way of 50 meters has the virtue of being able to be relocated if they find any resource or archaeological site that is not subject to mitigation.

Municipio Autónomo de Manatí
Tipos de Cuencas y Manantiales Según OPA



There are also two springs which are called Ojo de Guillo in Bajura Adentro and Aguas Frías in Río Arriba Poniente.

In conclusion groundwater quality is essential to the quality of life of residents and the viability of social and economic activities that take place in the Municipality.

Contamination:

Environmental contamination caused by human intervention usually causes undesirable changes in the conditions of the natural environment. The fumes from the manufacturing ´plants or from motor vehicles or burning in the open air can affect air quality. The spill of toxic substances or substances which are not biodegradable can contaminate land or water (surface or underground). Noise is another source of contamination that can affect the quality of life.

Due to the large number of pharmaceutical industries in Manati, the municipality is the center of an innovative program of public and private cooperation known as CAER: "Community Awareness Emergency Response." This program was established on July 16, 1986, through Resolution No. 1, Series 1986-87, which function is to establish a plan of coordinated assistance and protection to citizens in case of an emergency that arises in their industrial operations. Some of the industries that comprise the CAER Committee are: BASF Agricultural Products, DuPont Agricultural, DuPont Electronics, Bristol Meyers Squib, Ortho Pharmaceuticals, MOVA, Safety Kleen, Abbot Barceloneta, Abbot Pfizer Barceloneta, Inyx, Advanced Instruments, Inc., Agrocampos, Procter and Gamble and Cardinal Health.

In Manati the greatest threat is the contamination of the aquifer. As indicated above, the aquifer is important for all uses of land, both built by man to natural habitats.

One of the areas most sensitive to contamination of the aquifer is the area of the Tortuguero Lagoon. The Department of Natural Resources and Environment studied the matter as part of the Area Management Plan. Among the problems mentioned in the Management Plan for the Special Area of the Tortuguero Lagoon indicated that:

"In this area the DNR has registered 31 wells with significant withdrawals covering an average flow of 11,365 Mgal / day. They are used primarily by the AAA for domestic use (86.14%). Of the 31 wells cited, 26 are located in the drainage area of Tortuguero Lagoon so the extraction specific to this area is 6,095 Mgal / day. According to studies conducted by the SGF in 1985, it was considered that a discharge of 10,000 Mgal / day, combined with the extraction from wells for the year 1992 had a similar effect of 16,095 Mgal / day... In addition, the DFA of the DNR knows of the reduction in thickness of the fresh water column, which causes the deeper or coastal wells to be mostly affected by saline intrusion. Although the years between 1990-1992 the DNR quantified the degradation in water quality and intrusion of saline into several aquifers of the region, are considered in general terms, that the waters of the phreatic aquifer closest to PR State Road 2 in direction towards the south, can be utilized by users in the area".

Later in that same document stresses that the only parameter on the quality of drinking water that exceeds quality standards for the area of Manati is nitrate. It is suspected that the sources of such contamination are communities without sewer systems, runoff discharges that drain into sinkholes that are contaminated with fertilizers and pesticides and two illegal landfills.

With the intention of preparing a solid plan to help protect groundwater, the Municipality of Manati is in the process of extending the sewerage system in several communities that still depend on septic tanks; some of these communities can be seen in the following table:

Report of Septic Tanks Cleaned by Sectors 2007-2008		
NEIGHBORHOOD	**SERVICE**	**SECTOR**
Abra Vendig	6	Pueblo
Bda. Polvorín	12	Pueblo
Boquilla	5	Tierras Nuevas Saliente
Campo Alegre	22	Coto Norte
Cantera	78	Coto Norte
Cantito	48	Tierras Nuevas Poniente
Canto Marino	2	Coto Norte
Carretera 616	6	Tierras Nuevas Poniente
Carretera 670	4	Coto Sur
Carretera 686	1	Tierras Nuevas Saliente
Córdova Dávila	4	Pueblo
Estancias de Manatí	14	Tierras Nuevas Saliente
Estancias de Valle Verde	5	Tierras Nuevas Saliente
Guayaney	74	Tierras Nuevas Saliente
Haciendas Hermanas Menas	11	Tierras Nuevas saliente
La California	6	Pueblo
La Esperanza	6	Tierras Nuevas Poniente
La Laguna	37	Tierras Nuevas Saliente
La Luisa	6	Tierras Nuevas Poniente
La Prá	10	Coto Sur
Los Cintrones	3	Tierras Nuevas Poniente
Los Rábanos	63	Tierras Nuevas Saliente
Monte Verde	1	Coto Norte
Palo Alto	12	Coto Sur
Parcelas Márques	6	Coto Norte
Paseo Real (Negocio Sunset)	2	Bajura Afuera
Pueblito	6	Coto Norte
Reparto Curiel	4	Coto Norte
Reparto Roselló	4	Coto Norte
Reparto Yunel	1	Tierras Nuevas Poniente
San Fernando	2	Tierras Nuevas Saliente
San José	13	Pueblo
Tierras Nuevas	134	Tierras Nuevas
Valle Encantado	4	Cantito
Villa Borinquen	5	Coto Norte
Villas de Mar Chiquita	4	Tierras Nuevas Saliente
Santa Teresita	2	Tierras Nuevas Saliente
TOTAL	623	

Source: Sanitation Department, Municipality of Manatí

Municipal Recycling Program

Currently, the Municipality of Manati operates a Recycling Program, which recovered a total of 306,972 pounds. Among the materials that are mostly collected are ferrous metals and newspaper/paper.

List of Recyclable and Recuperated Materials
January through June 2008

Materials	Pounds Recuperated
Newspaper/paper	82,350
Plastic	42,675
Glass	45
Carton	5,489
Ferrous Metals	86,100
Nonferrous Metals	0
Vegetative Material	3,737
Ferrous Materials (Scrap Metal)	86,100
Tires	476
Batteries	0
Oil	0
Cartridges	0
Fluorescent Lights	0
Electronic Equipment	0
Wooden Palette	0
Total	**306,972**

Source: Recycling Department of the Municipality of Manatí

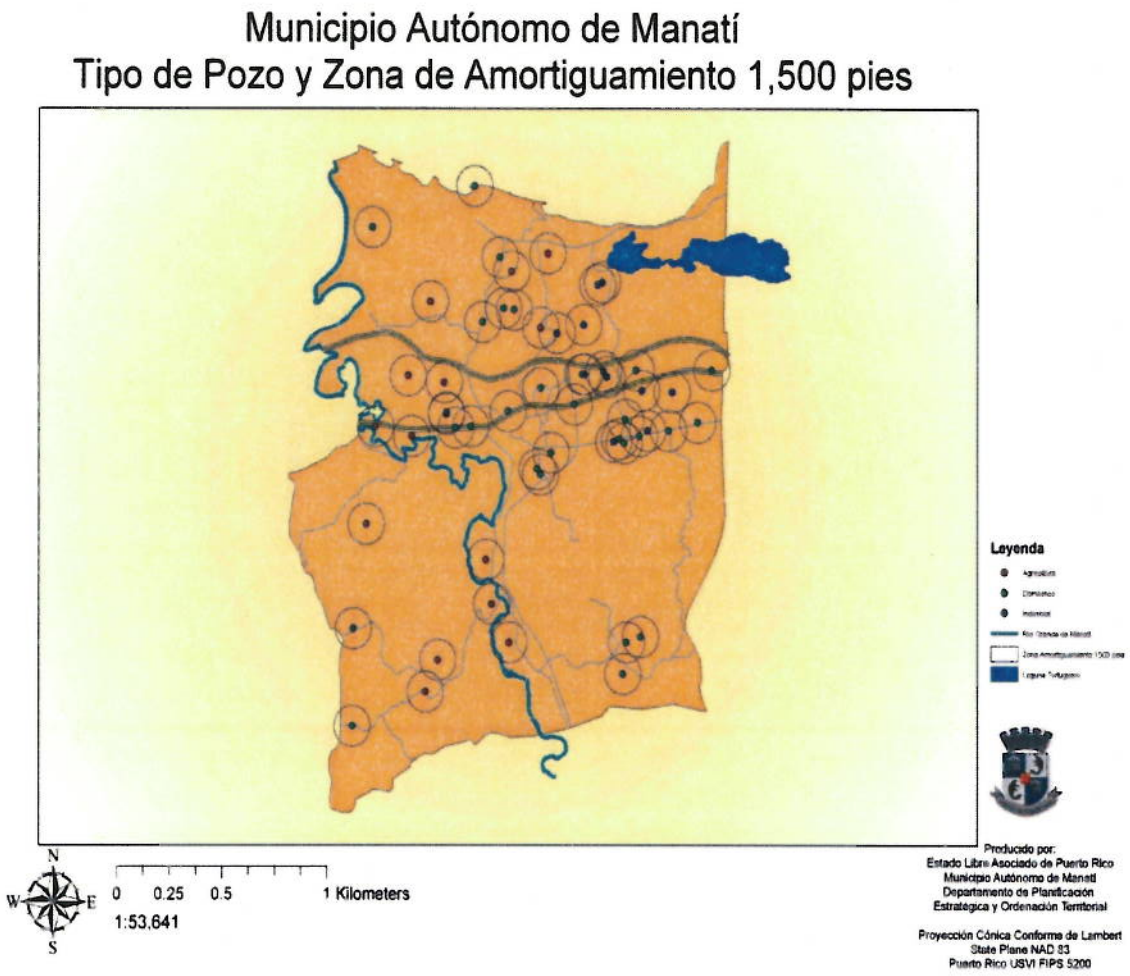
In addition, the Environmental Quality Board, in coordination with the EPA has developed a program known as "Program for Protection of the immediate area of drinking water wells." Within these protected zones, special attention is given to existing sources of pollution and avoids the creation of new ones. The protected zones will be initially delimiting based on a radius of 1,500 feet. As more information is received about how groundwater works, specifically regard to the speed of groundwater towards the well may change both the geometry as the extension to include those places from where a pollutant could reach over 5 years or less the water well.

In general, the Environmental Quality Board administers a series of permits that lets you prevent the establishment of new uses with high potential for contamination of underground water, such as;

1. Landfills
2. Underground Storage Tanks
3. Underground Injection Facilities
4. Disposal Facilities
5. Storage and Hazardous Waste Management
6. Warehouses for Toxic Substances
7. Agricultural Crops and Horticulture Companies
8. Livestock Companies
9. Minor Generators

Residential septic tanks are not currently covered by the federal and local regulations. Never the less, the existence of septic tanks within the protected areas will be considered by the Environmental Quality Board at the time of determining priorities for funding of the construction of sewers. The places where there are septic tanks within the protected areas will receive extra points to promote drainage projects. The following map shows a radius of 1,500 feet around each well. Also included is the location of two additional wells that the municipality is adding to the system to supply drinking water in order to expand the service to different residential areas that currently have supply

problems. According to the Program, it should be taken into consideration the existing wells that are inside of the protective zone.



The existing wells were established before the regulations of the Protection Program where established. As can be noted on the attached map, most of them had been established next to the land they served. For example industrial wells are located mostly within the property in which the pharmaceutical located. The same is true in regards to domestic water wells. Very often these were located near the land already developed, thereby increasing their risk of contamination.

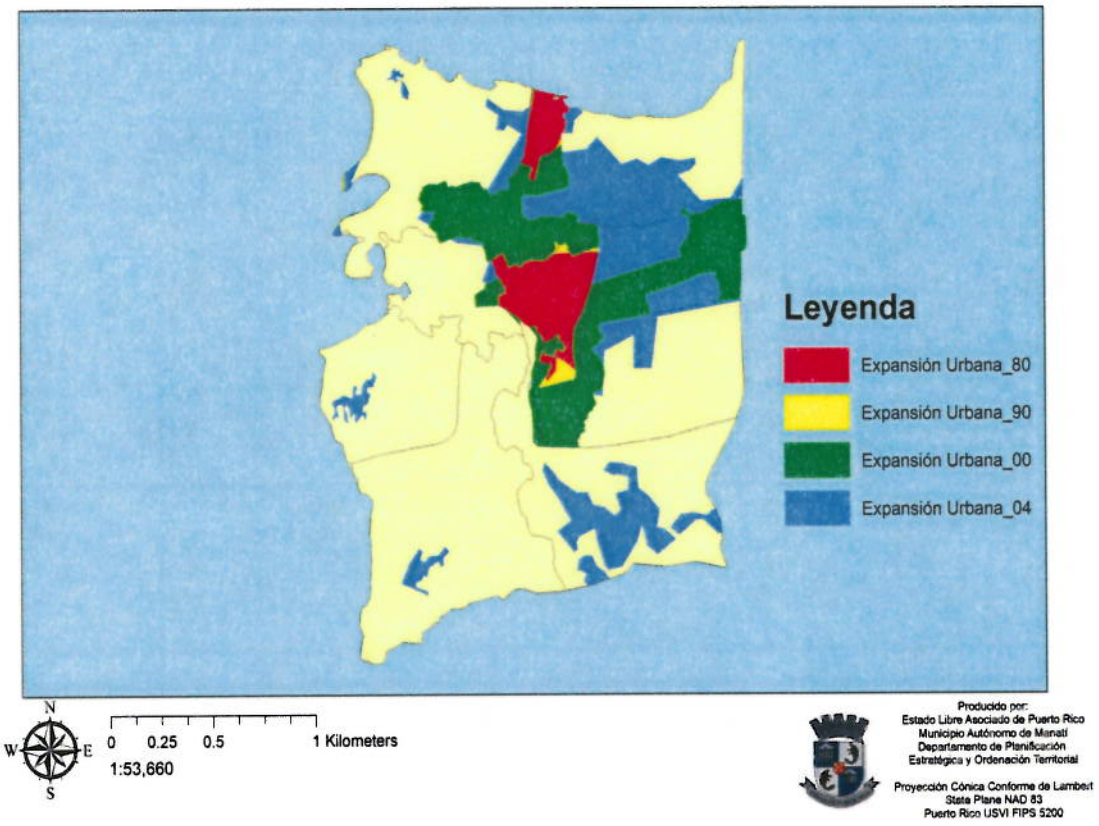
Urban Land:

According to the Plan of Land of Manatee approved by the Board of Planning of Puerto Rico in 2002 the urban land of the Municipality of Manati covers an area of 9,032,049.14625m^2 (2,298 cuerdas). These are located around the traditional center and the community of Boquillas. The Board of Pacification distributed the field of urban expansion of the Municipality of Manati between these two areas when adopting the Map of Urban Expansion in the seventies, and has maintained that way.

The largest of these urban sectors, with an area of about 5,062,349.50m^2(1,288 cuerdas), is placed around the traditional center. The second, smaller one with about 1,807,981.8975m^2 (460 cuerdas), is located on the coast near the community of Boquillas. A total of 9,032,049.14625m^2 (2,298 cuerdas) of land is declared suitable for urban development.

When the areas of urban expansion were originally adopted, it included both, land that was already urbanized and land in which it wanted to steer the development of new neighborhoods. Today, having passed several decades since the original designation, the type of development in the northern and the southern area are very different. In the northern area, 1,650,766.1625m^2 (420 cuerdas) of the 1,807,981.9875 (460 cuerdas) are still vacant. If we refer to the location of the infrastructure, we will see that the development potential of land included in the expansion towards the north, near the community of Boquillas has been limited by the lack of road, water and sewer infrastructure.

Municipio Autónomo de Manatí
Expansión Urbana 1980-2004



In the area of urban expansion near the town, where there is a diversely large number in infrastructure, the situation is different. Of the 5,062,349.565m^2(1,288 curds), only about 632,793.695625m^2 (161 curds) are vacant or under used with temporary uses. The other 550,255.3875m^2 (140 curds) are Limestone Hills that are not available for development. The vast majority of land within the area, just over 80%, is now consolidated into a set of urbanized institutions, businesses and industries.

The Limestone Hills included within the scope of urban expansion is increasingly well studied. Overlooked for development because of the higher costs of excavation, today they are part of the green areas of the town. Recent investigations have revealed that many have caves with petroglyphs, endemic and endangered species.

The Department of Natural Resources and Environment, at the request of residents of the area and their representatives, prepared a "Technical Report on the ecological value of Limestone Hills in Bo. Coto Norte Manati." Based on that study, the Department recommended the classification of the Limestone Hills in Coto Norte of Manatí, as specially protected rustic land. The Pacification Board upheld that recommendation and the Municipality also recommended such a designation. The area of urban expansion to which we have referred to, of 5,109,514.3125m^2(1,300 curds) was reduced by 47,164.7475m^2 (12 curds) of Limestone Hills in Coto Norte.

The Territorial Plan classifies all the land included within the area of urban expansion as urban land with the exception of the 47,164.7475m^2(12 curds) of Coto Norte Limestone Hills, which were removed from urban areas and has become classified as specially protected rural land.

In addition, the Territorial Plan includes land east of the area of expansion that the Planning Board had included in the basin of the Tortuguero Lagoon. This expansion of urban land covers an area of 2,161,717.59375m^2 (550 curds). It extends from the Limestone Hills south of the Diego Highway all the way to PR Road 670. Of the 2,161,717.59375m^2 (550 curds) about 393,039.5625m^2 (100 curds) are Limestone Hills with little prospect of development. Of the other 1,768,678.03125m^2 (450 curds), about 676,028.0475m^2 (172 curds) are vacant. About 60% of land classified as urban land in this area expansion, hence, is already built.

This sector is included as urban land because the land is already practically developed. In this area we can find DuPont Industries as well as housing and commercial developments. The area is well served by infrastructure. Even though the land that is inside the Special Zoning Area of the Tortuguero Lagoon, the majority of it has an urban characteristic. The urban land of the Municipality of Manati, therefore will have the following extension: